Review of the OESG progress report for the first effectiveness evaluation of the Minamata Convention

Danish Centre for Environment and Energy's (DCE) input to the work by the Open-ended Scientific Group (OESG) to the fifth meeting of the Conference of the Parties (COP-5) to the Minamata Convention on Mercury, 30 October – 3 November 2023

Scientific note from DCE – Danish Centre for Environment and Energy

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Data sheet

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Introduction and background

By email of 25. September 2023, the Ministry of Environment of Denmark requested the Danish Centre for Environment and Energy (DCE) to review the work conducted by the Open-ended Scientific Group (OESG) on the first effectiveness evaluation (EE) of the Minamata Convention on Mercury.

The Minamata Convention on Mercury, aiming to reduce global emissions of mercury, entered into force in 2017, and today counts 147 parties, including Denmark. The review by DCE has been requested by the Ministry of Environment of Denmark in relation to their participation in the fifth meeting of the Conference of the Parties (COP-5) to the Minamata Convention on Mercury, which will be held in Geneva, Switzerland, 30 October - 3 November 2023.

For the task, three documents were provided (Refs. 1-3). Ref. 1 is the main document outlining the framework for first EE. Ref. 2 lists and describes draft indicators to support the EE. Ref. 3 contains a progress report from the OESG including plans for monitoring data compilation and summary, summary of available emissions and releases data, and data analysis. DCE was requested to focus mainly on Ref. 3, which is therefore the focus of this review.

The framework for EE of the Minamata Convention is outlined in decision MC-4/11 (Ref. 4) and shown in Annex 1 in this note. The present stage for the OESG work is 'Party Review 1a' and 'Party Review 1b'. As mentioned in Ref. 3, the OESW aims to complete the reporting for the first EE to be completed by sixth meeting of the Conference of the Parties, which is expected to take place in 2025.

The OESG progress report (Ref. 3) contains sections on: 1) Summary; 2) Background; 3) The work carried out by the OESG since COP-4, when the decision to form the group was made; 4) Emerging and forward-looking observations for future discussions; 5) Expected results of the OESG work to support the first effectiveness evaluation; and 6) A time schedule for further work.

The section on the work carried out by the OEGS since COP-4 outlines subsections describing: 1) Plans for the monitoring data compilation and summary; 2) Plans for the summary of available emissions and releases data; and 3) Plans for data analysis.

The plans are kept in broad terms, as summaries, and do not go into details with the specific contents of the plans, such as, for example, which specific data types, formats, data suppliers etc., will be used. It is stated (bullet 20) that an update to the report will be made available prior to COP-5. Further, it is stated that complete plans will be available at COP-5 as annex 1, 2 and 3 to the UNEP/MC/COP.5/INF/24 document (bullets 36, 47 and 50).

These documents were not available to DCE at the time of writing and consequently, DCE can only comment on the broad aspects of the plans as presented in Ref. 3.

Comments and recommendations

DCE notes that the OESG progress report (Ref. 3) only presents a summary of the plans and not the complete plans. There are therefore many uncertainties on the specifics of the plans.

A. Plan for the monitoring data compilation and summary

Bullet 22:

It is stated that the main available sources of mercury monitoring data have been identified and include monitoring programmes, both ongoing and completed, as well as independent studies. However, the specific sources have not been listed. DCE recommend that data sources include primary research papers but also review papers that sometimes also report on new data.

Further, DCE recommends not only including monitoring data in the EE but also including and taking advantage of assessment data and evaluations already compiled in large-scale recent and earlier international monitoring and assessment reports within the framework of AMAP, EMAP, HELCOM and OSPAR including consecutive publications from this work (e.g., Refs. 5-6). This is in fact also emphasized in Bullet 4. Assessment data includes significance of linear/non-linear trends, % annual changes, and concentration levels relative to established toxicity/risk criteria for the investigated monitoring data.

The international assessments in the framework of AMAP, EMAP, HELCOM and OSPAR build on quality controlled/assessed data stored at international Data Management Centers (including ICES and EBAS), are performed at regular time intervals, are very comprehensive and constitute years of intense work by expert groups including a harmonized state-of-the-art statistical treatment of the data conducted in collaboration between AMAP, EMEP, HELCOM, OSPAR and ICES.

Time series in biota or in abiotic matrixes need to consist of many years of data starting well before the Minamata Convention on Mercury entered into force in 2017 to account for natural temporal variations in transport patterns due to the variability in meteorology, transport pattern in air and sea and for biota changes in food sources and migration of different species. Finally, long time series are needed to detect changes with statistical significance needed for the EE and the data series in AMAP, EMEP, HELCOM, OSPAR programs provide ideal data for that. Further, an open-access statistical tool HARSAT (Harmonized Regional Seas Assessment Tool) is currently under development to harmonize time trend analyses of AMAP, HELCOM, OSPAR data. The HARSAT tool is planned to be released in the end of 2023 and should likewise be applied for the planned EE work.

The latest 2021 AMAP Mercury Assessment analyzed 77 statistically robust timeseries of biota data, counting 3,500 individuals, from all over the Arctic to make comprehensive conclusions on the temporal and spatial mercury trends based on advanced statistical analyses (Refs. 6-7). To repeat such a major task using monitoring data from those programs in the Minamata EE does not seem cost-effective. Similar, analysis of atmospheric data has provided clear evidence of the connection between emission of mercury to the atmosphere,

observed atmospheric levels and trends as well as demonstrating that mercury indeed is a global pollutant that is being incorporated into human food webs.

Instead, DCE recommends adapting the assessment results data from the AMAP, EMEP, HELCOM, OSPAR programs in the EE work and engaging with the representatives of those programs to discuss how this is best done. Moreover, the AMAP, EMEP, HELCOM and OSPAR assessments contain identification of important knowledge gaps related to those regions that can be adopted for the EE work.

The work done in AMAP has been especially important in establishing the Minamata Convention due to the long time trend studies as described in Ref. 11: "Information from AMAP and the involvement of Indigenous Peoples and Arctic countries, were crucial in the negotiations leading up to the Minamata Convention, the preamble of which references the particular vulnerabilities of Arctic ecosystems and Indigenous communities". More considerations for incorporating AMAP data into EE for the Minamata Convention are summarized in Ref. 11.

Adapting regional assessment results, however, is not a global solution as there are many areas and regional around the world with no comprehensive regional (or national) mercury monitoring programs in place, such as Africa, South America, Australia, Antarctica, and Asia.

The resources saved from repeating the assessment of AMAP, EMEP, HELCOM, OSPAR data could be spent on much-needed capacity-building and establishing monitoring programs at key hotspot sites in areas without comprehensive monitoring programs in place such as China and the Philippines and developing countries in Africa and South America with artisanal mining using mercury amalgamation for gold extraction.

As outlined in the latest AMAP 2021 Mercury Assessment, a lot of climate and global warming processes are going on, which affect the observed time trend data. Among these changes are changes in transport routes, precipitation, changes in food chains due to new invasive species, changes in trophic levels of the monitored biota species, forest fires, releases from permafrost and melting from the Greenland Ice sheet. A recent study (Ref. 15) also documented that overfishing and ocean warming were drivers of increasing mercury concentration in predator fish such as cod and tuna. This is important as consumption of marine seafood is major source of methyl-mercury exposure to populations world-wide.

The EE program should aim at ensuring that proxies for such changes are included in the monitoring program as highlighted in Ref. 11. Such proxies, or ancillary data, includes monitoring of fatty acids and stable carbon/nitrogen isotopes to evaluate food chain composition and changes, and perhaps mercury isotopes to evaluate changes in mercury sources over time.

Bullet 26:

DCE recommends that data follow the FAIR principle (Findable, Accessible, Interoperable and Reusable) with regards to standardisation of data (Ref. 12).

The FAIR principle will ensure that the data and metadata is findable (e.g. using a DOI code) and the comparability of data sets across geography and time and ensure that data sets are open for scientific use and reuse, see also bullet 31.

Bullet 31:

DCE recommends that data suppliers are encouraged to follow the FAIR principle (see bullet 26). However, DCE also acknowledge that if this is a requirement, some data suppliers may not wish to supply data to the EE.

To approach this, retaining rights and ownership for the data providers to their monitoring data used for EE is a way to maximize contributions. This is not always straight forward. For example, data included in the ICES and EBAS Data Centre comes from a long list of sub-providers incl. historical institutions that no longer exist. It is not clear how this will be done. This also applies to other data centres such as the GMOS (Global Mercury Observation System) and the GBMS (Global Biotic Mercury Synthesis) database. Moreover, the funding institutions behind the data need to be visible for later acknowledgement.

Some funding sources require that the generated data should be public available and in some cases with a delay period of two years. Other science groups are quite reluctant to provide data before the data has been published.

The suggested data use agreements should ensure that that the data providers are secured proper credit and acknowledgement for their provided results that in some cases have been conducted in up to four decades. This applies to unpublished data as data already published in the literature can be used with proper citations.

Agreements between the secretariat and the data providers should be transparent, complete and legally-binding to ensure the maximum possible contributions and to ensure that the monitoring data is only used for the EE work if this is what the data provider has agreed to.

Bullet 32:

DCE evaluates that collecting, organizing, and storing monitoring data will be a huge task requiring substantial resources. However, the task will depend on the decided data management infrastructure (see comment to Bullet 35).

Bullet 35:

The data management infrastructure remains unclear. For example, it is not clear how the monitoring data will be stored for the EE work, if data will be public accessible, and if this is the case, who will cover these costs of running such data centres. Human data are hard to access due to the personal sensitive information.

DCE do not recommend establishment of parallel data centres to for example the ICES and EBAS Data Centres containing the same data. The ICES Data Centre contains environmental data collected in the AMAP/HELCOM/OSPAR frameworks and the EBAS Data Centre contains atmospheric data collected in the AMAP, EMEP og WMO-GAW frameworks. Instead, DCE recommends drawing data directly from the ICES and EBAS Data Centres. This will be more cost-effective, so data providers should not send data twice potentially in different formats and will ensure that the data are up to date and have the highest quality as they already have been quality evaluated. In addition, several of the discussions on formats of reporting's have been harmonised and improved over decades.

B. Plan for the summary of available emissions and releases data

The list of data sources is adequate for assessing the national mercury emissions, but these inventories do not include a geographical seasonal distribution and therefore they are not fitted for model calculations of mercury in the environment. To this end, inventories like AMAP/UNEP, EDGAR, STREETS are needed.

C. Plan for data analysis

It is not clear from the plans how the previous Global Mercury Assessment (Ref. 8) and the methods and lessons learned from this work are integrated in the EE work by the OESG, and if this can be enhanced.

DCE recommends looking into this and further consider if the Global Mercury Assessment from 2018 (Ref. 8) could serve as baseline for the first EE since it provides a global assessment from the time right after the Minamata Convention entered into force.

Bullet 48:

DCE recommends compiling and applying updated knowledge from the peer-reviewed scientific literature in addition to previous Global Mercury Assessments (Refs. 8-9). Such work should be conducted especially with focus on regional and global mercury budgets and cycles, to address the guiding questions in each EE round (in addition to the data analyses). This is a big task requiring expert knowledge and substantial resources.

DCE did not find this mentioned in the plan, neither at which intervals such assessments should be conducted. Knowledge on the regional and global mercury budgets and cycles, and the complex biogeochemical processes involved, is critical to understand the links between emissions/re-emissions, pathways and accumulations in biota/humans and climate change effects, and ultimately to interpret the results from the monitoring data analyses in relation to the EE.

Regional and global mercury budgets evolve constantly as models improve and more input data becomes available. As an example, a recent study based on the latest advances in mercury cycling and a coupled atmosphere-land-ocean model (Ref. 10) suggests a 40% increase in total atmospheric emissions compared to previous estimates, mainly due to higher re-emissions from the oceans, thus buffering the effect of reduced primary emission reductions. This estimate will likely change in the future as models improve further. However,

such information needs to be considered when interpreting the monitoring data in the EE.

Moreover, marine biota impacted primarily by ocean-transported mercury will likely take several hundred years to adjust to any changes in primary emissions as the estimated overall turnover time for total mercury in the ocean is 320 years or more (Ref. 14).

It is not clear to DCE if the ambition of the EE is to cover all the above (recommended) or if the EE will mainly focus on data for emissions and selected key sentinel species, including important food sources for human consumption.

D. Emerging and forward-looking observations

There is good evidence that gaseous elemental mercury can be measured in a reproducible and traceable way with little uncertainty. The situation is different for gaseous oxidized mercury (GOM) and particulate mercury (PM). Here there is raised doubt of the reliability of measurement techniques (Ref. 13). Despite that GOM and PM in general are found at much lower concentration, they are very important for understanding the fate of atmospheric mercury. Therefore, DCE recommends the development of new measurement techniques for GOM/PM as it is important to fulfil the requirement of assessing the effect of the Minamata Convention.

Progress have been made with respect to including mercury stable isotopes, which can add to the information of sources and climate related changes of pathways over time that may improve detection of sources to hot spot areas around the world. DCE recommends considering if some on the ongoing monitoring programmes can be improved by expanding these programs with mercury stable isotopes.

Finally, the recent AMAP Mercury Assessment (Refs. 6-7) documented differences in the statistical power and trends related to the specific matrices used. DCE recommends taking such information into account when updating programmes and evaluating the time trend results.

Bullet 51b:

DCE recommends that data should be provided under the FAIR principle.

Bullet 51j:

DCE recognizes that the data harvesting and interpretation of results is a huge job, and it will request substantial resources for succeeding.

Bullet 55-57:

The timeline appears unrealistic and DCE recommends revising it. DCE fully supports the considerations in Bullets 56 and 57 concerning the timeline for data collection and the limited financial resources available from the Convention to fund the work, which will not enable the OESG to make a comprehensive analysis of the relevant information. DCE recommends that a realistic financial model is developed.

Bullet 58:

DCE evaluates that the scheduled final Conference of the parties in November 2025 is too soon for a policy-oriented meeting.

List of references

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(14) Kawai, T., Sukurai, T., Suzuki, N., 2020. Application of a new dynamic 3-D model to investigate human impacts on the fate of mercury in the global ocean. Environmental Modelling and Software, 124, 104599.

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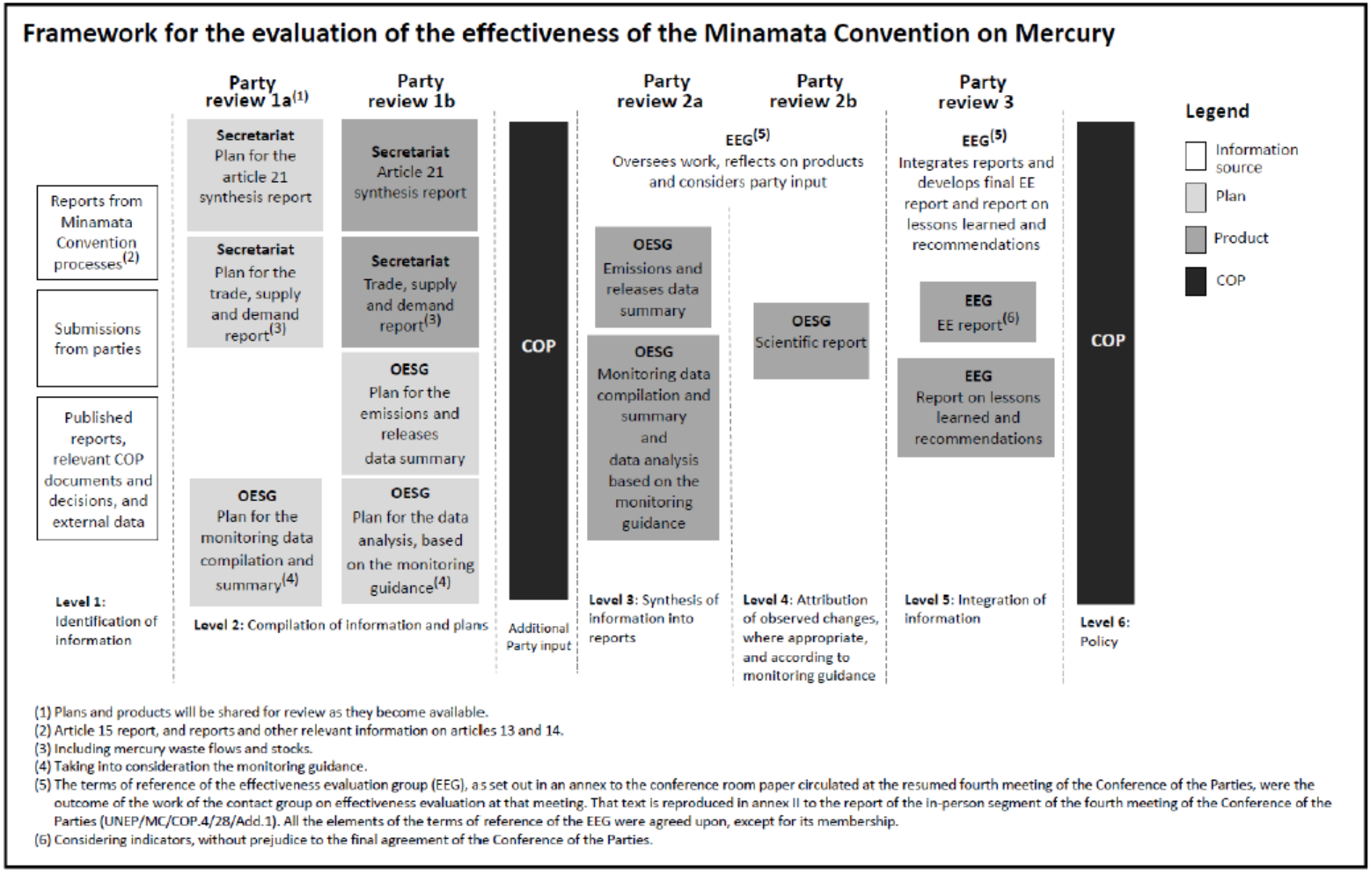
Annex 1. Framework for the effectiveness evaluation as included in Annex 1 to decision MC-4/11 (Ref. 4)



(1) Plans and products will be shared for review as they become available.
(2) Article 15 report, and reports and other relevant information on articles 13 and 14.
(3) Including mercury waste flows and stocks.
(4) Taking into consideration the monitoring guidance.
(5) The terms of reference of the effectiveness evaluation group (EEG), as set out in an annex to the conference room paper circulated at the resumed fourth meeting of the Conference of the Parties, were the outcome of the work of the contact group on effectiveness evaluation at that meeting. That text is reproduced in annex II to the report of the in-person segment of the fourth meeting of the Conference of the Parties (UNEP/MC/COP.4/28/Add.1). All the elements of the terms of reference of the EEG were agreed upon, except for its membership.
(6) Considering indicators, without prejudice to the final agreement of the Conference of the Parties.